Guidelines for use of Portable Air Filtration Systems in Healthcare Facilities

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I. Background:

Most portable air filtration devices utilize high efficiency particulate air (HEPA) filter media to "clean" or "scrub" air in a room or area by trapping small particulates in the filter media. While design varies by manufacturer, users need to understand that these devices filter and then discharge air back into the surrounding environment. Therefore, these devices **do not** automatically create the same conditions as an airborne infection isolation room (AIIR). An example of where this device is used that might be familiar to healthcare facilities is to filter air in an area that is undergoing renovation or construction. During demolition of existing rooms or units these devices are used to filter and contain dust and other particles created during demolition activities. These are used in combination with sealing off return air grilles, and often supply air grilles as well, to contain particulates as much as possible. Another common example is to contain airborne infectious agents that might be produced during care of a patient with a suspected airborne disease such as active tuberculosis (TB).

The Minimum Design Standards for Health Care Facilities in Michigan, published in 1998 and formally adopted by legislation in 2002 require Emergency Departments in Section 7.9.D22 to provide at least one negative pressure AIIR. Those health care facilities that do not already have such a room in their ED should seriously consider renovation or new construction to provide one. In the interim, facilities may benefit from the use of a portable HEPA filter unit equipped with the proper fittings/ducting to exhaust air from a selected room to create the required negative pressure environment.

II. Possible Applications of Portable Air Filtration System for Containment of Airborne Infectious Agents

A. Placement of Portable Air Filtration Device to Create a Negative Pressure Airborne Infection Isolation Room

1. A portable HEPA device **will not** create a negative pressure room unless it can be discharged directly to the outside. Please Note: A standard 10 x 15 x 9 examination room would probably be ventilated at a rate of 100- 150 cfm (4-6 ACH). Trying to connect a HEPA unit which discharges at a rate of 625 cfm into a return duct to create a negative pressure room would pressurize the return duct and result in blowback into adjacent rooms. This would not be acceptable.

For flexibility, it is possible that a number of ducted connections to the outside could be installed so that the unit could be placed in any of the rooms so equipped to create a negative pressure isolation room. This would require access to an outside wall or the roof for discharge of the air from the unit. It would probably not be practical to set up more rooms than you had HEPA units available. When the portable HEPA device is connected in this way, return air grilles must be sealed off.

2. If an access to the outside and/or a ducted connection to the outside is not available, for the short term, consider closing off both supply and return from the room into which the portable HEPA is placed. This will not result in a pressurized room (either positive or negative) but should minimize the airflow from the room into the corridor or surrounding space.

3. If an air handling unit (AHU) serving the area has an economizer mode that is capable of 100% outside air, manually switch to this mode to provide exhaust from all of the rooms served by the AHU. (Caution: Relief air discharges are not always adequately isolated from supply air intakes.) This would avoid recirculation of the air from a room with an infectious patient into other areas. The HEPA device would provide additional air changes within the room, and would remove some of the airborne contaminants. This must be coordinated with the facility engineer to ensure the design of the air handling system will accommodate such conditions without adverse effects (such as freezing coils).

B. Placement of the Portable Air Filtration Device in Any Area (triage room, ED waiting room, ED exam room, etc) for Temporary Emergencies or Continuous Air Scrubbing

Placement of the portable air filtration device as a contingent intervention during emergencies or care of a patient(s) with suspected airborne disease in any area (triage room, ED waiting room, ED exam room, etc) must be done in consideration of the following:

1. The device must not create an obstruction that would interfere with the proper delivery of health care.

2. Personnel in the unit must understand that activation of this device does not provide negative pressure, nor an AIIR and that, as soon as possible, the patient with suspected airborne infectious disease will be moved to a AIIR meeting MI Minimum Design Standards, 1998.

3. The device should be placed so as to maximize air mixing for better air scrubbing effectiveness (unless circumstances prevail that dictate a more controlled air flow). With any airflow device the direction of air flow must be from clean to less clean to minimize the spread of contamination. For example, if the unit were placed in an ED waiting room and several victims walked in contaminated with some hazardous/infectious powder, it would be imprudent to have the unit air flow cause greater mixing of the powder. Points 4-7 address related issues.

4. The intake of the device should be placed as close to the expected source of the contamination as possible to increase effective capture of the infectious/hazardous agents. Capture ability decreases with the square of the distance from the intake, so the distance from the patient has an impact on the ability to filter out droplet nuclei.

5. The device should normally be placed so that it does not draw contaminated air past the breathing zone of the caregivers.

6. The air flowing out of the device must not be directed in a way that would cause discomfort to patients, visitors and staff.

7. Consider closing off both supply and return from the room into which the portable HEPA device is placed. This will not result in a pressurized room (either positive or negative) but should minimize the airflow from the room into the corridor or surrounding space.

C. Other Considerations

1. The use of the portable filtration device within the facility should be guided by a written policy that is created using information in these guidelines and should be customized specific for the hospital with appropriate reviews and approvals from infection control, administration, clinical and facility engineering and the departments in which the units will be used.

2. The portable air filtration device should not be plugged into a power strip or extension cord. The unit should require standard single phase 110/120 volts and should be plugged into an electrical receptacle on a circuit having an amp rating adequate for the unit's power draw. It is highly recommended that an emergency power outlet be made available for the device.

3. If the portable air filtration device has adjustable air flow, the air flow should be selected that is appropriate to the size of the room to give the desired air changes per hour (a minimum of 12 air changes per hour). Do not allow unauthorized access to the machine's controls. If the HEPA machine has a locked control panel, keep the key where authorized staff can access it, but not patients and visitors. Unless other considerations (such as noise, discomfort of blowing air, etc) prevail, the unit should normally be run at the highest fan setting since this will provide the maximum filtration and air changes per hour. In smaller rooms the recommended minimum 12 air changes per hour may be achieved at a lower fan setting. Under these conditions, the users may opt to lower the fan settings.

   Note: Since these units may be used on a continuous basis to simply scrub the air to help remove contaminants, it is understood that they may be used in areas that are not designed to the ideal that have neither negative pressure nor 12 air changes per hour.

4. Room(s) into which devices may be utilized for emergencies and other contingencies should be chosen beforehand, noting carefully the following factors:

   a. If possible, choose a room where noise from the machine will be less disruptive than in others

   b. If the unit will be exhausting through the window -
      - Choose a room that is not adjacent to or otherwise affect ventilation intake ducts
      - Have facility engineering build and store an interface panel for the window-pane prior to the machine's use, which will fit the removed pane and provide a tight seal for the HEPA exhaust.

5. For negative pressure AIIRs, clinical and/or facility engineering should check the machine on a daily basis while in use and measure the degree of negative pressure between the room in which it is situated and adjacent/affected areas (i.e. the corridor outside the room and, if exhausting into existing ductwork, rooms that could be affected by imbalance between exhaust and air flow).

6. Consider putting together a checklist to establish that the proper room is being used, the intake duct in that room is blocked, the filter is placed properly, etc.

7. Portable air filtration devices require proper preventive maintenance for their effective continued operation.

   a. The procedure should specify recommended personal protective equipment (PPE) when performing maintenance on the unit.

b. The maintenance procedure should be performed in an area safely away from any patient locations. It is recommended that it be done in some maintenance location that has appropriate ventilation including negative pressure, designated for such activities. The area should be contained and easily cleaned/decontaminated.

c. Based upon manufacturer's recommendation and any additional suggested protocol from facility maintenance, a standard routine maintenance procedure should be developed for the unit. Such maintenance should include items such as (but not limited to):

- Changing of pre-filters (on a schedule or as needed per magnehelic gauge) Be sure to include details on appropriate PPE, use of "bag out" protocol (to contain particles that might be trapped in the filter media) and proper disposal of filters consistent with the facility's waste management procedure.
- operational check for proper operation
- interior cleaning of unit if needed (without disturbing seal on HEPA filter)
- changing of UV lamp (if so equipped) per manufacturer recommendation (based on hrs of use)
- general safety check (electrical & mechanical)
- lubrication where needed (Note: fans, etc should have sealed bearings and should not require lubrication)

9. The HEPA device must be leak tested and certified. This should be done initially when the equipment is received, at least annually thereafter, and every time the HEPA filter is changed. The frequency of changing the HEPA filter should be based upon manufacturer's recommendation (e.g. annually or when indicated by the manometer (differential pressure gauge) across the HEPA filter).

10. The portable filtration unit should be monitored regularly (e.g. daily for negative pressure AIIRs) for leaks. This can be done by simply having designated staff monitor the pressure drop across the filter by checking the gauge.

Facilities contemplating use of the portable air filtration devices as described above are welcome and encouraged to contact the engineering staff of the MDCH Health Facilities Engineering Section for further assistance with their particular installation. We can be reached at 517-241-3408.